

# **1993 SEAGRAVE TRIPLE**

Make SEAGRAVE TRIPLE Model TB-50CF Year 1993

Laden Weight 33.700 Front 17.120 Rear 16,600

Tire Size Front 385/65R-22.5 Rear 12R-22.5

Make of Engine CUMMINS Model N14-370 Horsepower 370

No. of Cylinders 6 Cubic Inches 855

Capacity: Fuel 50 gal

Crankcase 44 qts SAE 15w-40

Transmission 6 gal SAE 50

Pump Transmission 24 pts SAE Dextron II

Differential 47 pts SAE 90-140

Power Steering \*ar pts SAE 10w

Water Tank 500 gal

Cooling Tank 64 qts.

Transmission SPICER PS-145 7A 7 SPEED

Main Pump WATEROUS CMUYCX Type 2-STAGE CENTRIFUGAL

Rated Capacity 1500 gpm @ 150 psi

Priming Pump WATEROUS, Type -ROTARY VANE- POSITIVE DISPLACEMENT

\*As required

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## **ENGINE:**

Model.....	N14-370
Maximum Horsepower.....	370 hp
Peak Torque (1200 rpm).....	1400 lb-ft
Governed Speed.....	1950 rpm
No. of Cylinders.....	6
Bore and Stroke.....	5.5" x 6.0"
Engine Displacement.....	855 cubic inches
Compression Ratio.....	16:1
Operating Cycles.....	4
Oil System Capacity.....	11 gallon/44 qt
Oil Pressure.....	10 psi at idle, 700 rpm 35 psi at 1200 rpm 45 psi ar 1950 rpm
Operating Range.....	1100-1600 rpm
Engine Temperature Operating Range.....	165° – 195° F warning light at 220° F
Engine Heater.....	120° – 140° F

## **SPECIFICATIONS:**

Fuel Tank.....	50 U.S. Gal
Starter Motor.....	12 volts
Batteries.....	Lead acid 12 volt/6 batt
Cab Hydraulic Pump Reservoir.....	Dexron type fluid ATF
Fire Pump.....	1500 gpm at 150 psi 150 gpm at 600 psi
Relief/Dump Valve.....	Set at 250 psi
Alternator.....	160 amps/14.2 volts
Rear Axle.....	RS 23 180
Gear Ratio.....	3.73:1
Transmission.....	PS 145-7A, 7 speed

## **DIMENSIONS:**

Length.....	329" = 27' 5"
Width.....	96" = 8'
Height.....	114" = 9' 6"
Cab Tilt Height.....	167" = 13' 11"

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## **ENGINE:**

- ◆ Cummings, N14-370 diesel, 6 cylinder valve in head type
- ◆ 5½" bore and 6" stroke
- ◆ 855 cubic inch
- ◆ Compression ratio – 16.0 to 1
- ◆ Highest torque – 1400 ft lbs at 1200 rpm
- ◆ Highest horsepower 370 at 1600 rpm
- ◆ Operating range 1100 rpm to 1600 rpm
  
- ◆ Can run an additional 7% on high idle.

**NOTE:** This can be very harmful if engine is cold. Due to minimal lubrication.

- ◆ After engine starts; check oil psi and alternator output.
- ◆ The N-14 is designed to run at lower rpm
- ◆ Driving at lower rpm:
  - delivers best performance
  - largest engine life
  - best fuel economy (1100 to 1600 rpm)
- ◆ N-14 delivers greater torque and pulling power at low rpm.

## **Step Timing Control (STC): Hydraulic System**

- ◆ Step timing control (STC) controls engine timing to minimize white smoke at cold engine start-up.
- ◆ STC has two stages of injection timing
  1. Advanced Mode – during starting and light engine loads conditions.
  2. Normal – during medium to high engine load conditions.
- ◆ STC advantages during ADVANCED injection on timing are:
  1. Improves cold-weather idling characteristics
  2. Reduces cold-weather white smoke
  3. Improves light load fuel economy
  4. Reduces injector carboning.
- ◆ STC advantages during NORMAL injection timing are:
  1. Controls cylinder pressure
  2. Reduces nitrogen oxide emissions

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- ◆ When operating in ADVANCED mode – a light ticking noise may be noted at the overhead. This is caused by the actuation of the STC hydraulic tappets during each injection cycle. This is normal.
- ◆ During prolonged idling – maintain at least **900 –1100 rpm** to keep temperature from falling below normal temperature.
- ◆ The incomplete combustion in a COLD engine will cause: **plugged injectors, crankcase dilution, formation of laquer and/or gummy deposits** on rings, pistons and valves and sludge in the engine.
- ◆ **After heavy use – idle for 3 to 5 minutes** to cool engine prior to shutdown.
- ◆ With hot engine stopped suddenly, the turbocharger's temperature could rise as much as **100 degrees F.**
- ◆ If engine rotation increases by 200 to 300 rpm above rated speed may damage the engine. Valves may hit the pistons (valve float), increased oil consumption, injector plunger seizure, and other damage requiring major repairs.

### **FUEL SYSTEM:**

- ◆ 50 gallon fuel tank
- ◆ Shut-off is mounted forward of the fuel tank above the rear axle.
- ◆ Ignition switch on instrument panel operates fuel pump with a solenoid valve.
- ◆ Fuel pump is equipped with a knurled knob mechanical valve for opening an emergency.
- ◆ If ignition switch breaks solenoid wire or solenoid burns out or battery voltage drops below nine volts and engine won't start, try the following.

**FIRST:** Tilt the cab and locate fuel pump (left side of engine)..Solenoid is located on top of the pump.

**NEXT:** Manually screw knurled knob "clockwise." This will open the fuel solenoid valve, and fuel will flow through to the pump.

**NEXT:** Start engine. You may operate like this. TO STOP engine turn knurled knob counter-clockwise.

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NEVER leave the knurled know screwed in with the engine shut-off. This can allow fuel to flow through fuel pump past an open injector and fill a cylinder with raw fuel. This causes a hydraulic lock in the cylinder series damage.

- ◆ Keep the fuel tank FULL. This minimizes condensation forming in the tank and also keeps the fuel at the proper temperatures.
- ◆ RAYCOR fuel filter/water separator, access to filter is gained by tilting cab (left side of engine).
- ◆ Frequency of water draining or filter replacement is dependent upon contaminants of fuel.
- ◆ Inspect/drain collection bowl for water weekly.
- ◆ To drain water:

1. Loosen self venting drain to drain bowl of water (counter clockwise)

NOTE: Due to a vacuum created to fuel system when opening drain some air will enter the collection bowl. Leave drain open and fuel will start to drain out of the drain vent.

2. Tighten drain, run engine, check for leaks.

- ◆ Filter replacement is done annually at pump test.
- ◆ When water and/or contaminants accumulate in separator bowl and reach a predetermined level:
  1. Warning light and
  2. Audible buzzer will sound.

Drain bowl “as soon as possible.” Engine could stall and serious damage done if water is not drained out of bowl.

### **THREE STAGES OF FILTRATION**

- ◆ Primary Stage (Separation)
  - Contaminant 30 microns and larger are separated out by centrifugal action created by the turbine centrifuge.
  - Contaminants heavier than fuel, fall to bottom of bowl.

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- ◆ Secondary Stage (Coalescing)
  - Minute particles (lighter than fuel) flow with fuel into blower part of filter/separation shell.
  - Minute particles accumulate on inner wall of shell and a specially treated replacement element.
  - As particles/beads accumulate they become larger, heavier, and fall to bottom of filter/separation bowl.
  
- ◆ Third Stage (filtration)
  - Fuel flows through the replacement element where minute solids are removed.
  - Change element @ 8 to 15 inches of restriction.
  - Warning light on left side of dash indicates fuel filter/water.
  - Check separation bowl, drain daily.
  - Drain filter/separation bowl prior to contaminants reaching bottom of centrifuge assembly.

### **ENGINE COOLING SYSTEM:**

- ◆ Water pump mounted on front of engine.  
Water pump has packless seal and requires no lubrication.
  
- ◆ Equipped with a system conditioner to filter, provide electrolytic protection and to act as a rust inhibitor. A portion of the coolant is circulated through the conditioner at any time that the engine is running located on the right side of engine block next to oil filter.
  
- ◆ The importance of a properly conditioned or inhibited coolant liquid cannot be overstressed. An improperly inhibited coolant can:
  1. Become corrosive enough to “eat away” coolant passages and seal ring grooves and cause coolant leaks to develop
  2. Cause liner scuffing.
  3. Scoring
  4. Piston seizure
  5. Cylinder head cracking

An engine effected in the manner overheats gradually over a period of weeks or months.

- ◆ A coolant, which has insufficient inhibitors, invites the formation of rust and scale within the cooling system.

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- Rust, scale and mineral deposits can coat walls of the cylinder block, water jackets and outside of cylinder liners. As deposits build up they insulate the metal and reduce rate of heat transfer.
- Improperly inhibited coolant can also contribute to cavitation erosion, caused by collapse of bubbles, formed at the coolant side of an engine component (pressure differential in liquid cause by vibration of the engine part).
- ◆ Check Coolant level
  - Most important to visually check condition of the coolant. Rust? Clear water? Inform Shops.
  - Check water pump weep hole. If leaking seal has worn out.
- ◆ Coolant recovery tank located outside of cab under Captains seat. Can be maintained full without tilting cab.  
  
\*Hot and cold marks on recovery tank (actually on diamond plate).
- ◆ Engine heater maintains coolant's temperature at 120 to 140 degrees, it is a 110 v AC, 1000 watt, direct immersion type. It shall be connected when in quarters.
- ◆ Radiator Cap is pressure relief type with 7 lbs. rating. This allows the coolants temperature to rise to 233 degrees before boiling.
- ◆ **Deaeration tank** purges air, which could become trapped in the cooling system from circulating through the system.
- ◆ If possible, do not permit engine water temperature to exceed 200 degrees

### **Cooling Fan:**

- ◆ The fan is bolted directly to the hub and continuously turns while the engine is running.
- ◆ Driven by two vee belts.

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## **ENGINE LUBRICATION SYSTEM:**

- ◆ 35 psi at 1200 rpm
- ◆ 45 psi at 1950 rpm
- ◆ 10 psi at idle
- ◆ Force-feed wet sump system integral with lower case of engine.
- ◆ Lower case holds 38 quarts of oil, 6 in filter or other related engine lubricating oil system.
- ◆ Viscosity Sensor Control (STC engine only):
  - Controls main oil refill pressure by modifying the oil pressure signal to the lubricating oil pump pressure regulator.
  - Allows higher than normal main oil rifle pressure with cold oil to improve oil full of the STC injector tappets and to provide maximum engine timing advance and white smoke control.
  - When lube oil warms up, high pressures are no longer needed to fill STC tappets. Viscosity Sensor than allows main oil rifle pressure to return to normal levels to reduce parasitic horsepower loss.
  - Lubricating oil pressure gage will read (as much as 100 psi) during cold start up until lube oil warms up.
- ◆ An oil cooler of the heat exchanger type is located on the right side of engine block.

## **ELECTRICAL SYSTEM:**

- ◆ **REFER TO TRAINING BULLETIN #65**
- ◆ Lead acid 12-volt batteries, 6 of them.
- ◆ Valid at 950 CCA at 0° degrees F each
- ◆ A 1993 Cummins Diesel with 855 cubic inches @ 1710 amps to start.
- ◆ Batteries connected in parallel to rest of electrical system. This allows alternator on board charger to charge all batteries simultaneously.
- ◆ Use of 800 MHz radio and MDT Unit create a constant 8 amperes per hour draw on battery system.
  - Thus a 40-amp battery charger has been installed on each rig.
- ◆ Heavy apparatus must be plugged in when vehicle is in quarters.

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- ◆ Battery Charger:
  1. Left ammeter shows amount of charge.
  2. Right ammeter shows is disconnected.
  3. Will automatically shut off when batteries are at full charge. Ammeter will read zero and a GREEN light on front of charger will activate.
  
- ◆ When apparatus is placed out of service (over ten hours) radio “cut-off” switch must be turned off (located between Captains seat and firefighter jump seat).
  
- ◆ Low voltage warning system:
  - Audible device activates when batteries fall below 11.2.
  
- ◆ Battery Cable – the battery master switch must be in the OFF POSITION. Before moving the battery cables, this will present a spark from happening at the terminal and igniting the hydrogen and oxygen gases being omitted from the battery. It is not necessary to turn off the radio when charging.
  
- ◆ 12 volt starting motor – Do not crank over 30 seconds. Hesitate about 30 seconds before retrying.
  
- ◆ Running engine slightly above idle speed will be enough to supply the entire electrical system with adequate voltage. Raise RPM above idle speed ONCE.

### **CHARGING SYSTEM QUICK CHECK:**

<b>ENGINE MODE</b>	<b>VOLTMETER READING</b>	<b>CONDITION</b>
Battery switch on ignition switch on engine not running no electrical load	12.2 – 12.8	Batteries ok
Same condition as above	Below 12	Recharge battery
Engine running (1 min. or more) approximately 1000 rpm – no load	13.8 – 14.2	Check alternator ok
Same as above	Below 13.8	Check alternator - belt tension – alternator b.o.
Engine running (1 min. or more) approximately 1000 rpm - full load (all lights on)	13.5 – 14.2	Charging System ok
Same as above	Below 13.5	Check alternator - belt tension – check battery – condition – alternator b.o.

The above information does not supersede the standard battery maintenance program as recommended in the F-377, but is intended to be followed only as a quick daily check to make sure the charging system is functioning in a normal manner. Keep the batteries at full charge at all times.

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## **AIR CONDITIONING UNIT:**

- ◆ Two A/C Units each has a drip pan for condensation. When drip pan fills water will overflow into the overflow tank. The overflow tank has a pump to automatically drain it.
- ◆ Drain hose for overflow tank terminates behind left front tire. During normal operation water will drain from this hose.
- ◆ If drain hose get clogged, water will begin to leak from bottom of A/C Unit. Notify shops if this is excessive.
- ◆ Driving over rough terrain can cause water to splash over drip pan and leak out of A/C Unit.
- ◆ When in use it is normal for some water to leak into cab. Due to sweat from evaporator.
- ◆ Each unit has one air filter to keep dirt out of evaporator. Made of a nylon material.
- ◆ Periodically check both filters for dirt. A dirty filter will cause WARM air to come from A/C unit. Shops clean and service filters.

## **ALTERNATOR SYSTEM:**

- ◆ Is an alternator with a built-in rectifier and regulator assembly.
- ◆ Rectifier changes AC to DC – current then goes to the battery.
- ◆ Produces a maximum of 160 amps @ 14.2 volts @ low engine RPM's
- ◆ Alternator bearings are lubed/sealed at factory.
- ◆ If voltmeter fails to show a charge, when it should, CHECK ALL CONNECTIONS FOR TIGHTNESS and wiring for breaks. If this fails to remedy the situation, notify the SHOPS.

**Circuit Breakers** protect the electrical system.

If a short occurs, the breakers heat up, and click open. When they cool they close, making another clicking sound. Unless the short has been fixed, the breakers will open again. This “clicking” sound will continue until faulty circuit has been found.

**NOTE:** Even if the short has been fixed OR isolated, the Shops should be notified.

**DUAL BRAKE SYSTEM:** (also called split brake system)

- ◆ Brakes are by ROCKWELL Dura Master Disc Brake System.  
E-8 BENDIX – WESTINGHOUSE – E8 brake application valve is heart of system.

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- ◆ TWO separate supply and delivery systems – Service and Emergency.
- ◆ Air pressure is lost in secondary system – braking goes on in a normal manner.
- ◆ Air pressure is lost in priming system, the E-8 brake application valve will allow the air pressure from the secondary system to come into the primary system, to equal the amount of mechanical pressure being applied at the pedal.

## **SPRING BRAKES:**

Spring brakes effect the rear wheels only brake is applied by ABSENCE of air, by spring pressure.

To apply the brakes: Pull yellow button, located on the console.

To release the brakes: Push the yellow button until there is enough air in the system to hold the brakes off.

## **Three Primary Uses of the Spring Brake:**

1. Emergency brake
2. Parking brake
3. "Low pressure starting" protective device

If spring brakes cannot be released and the apparatus must be towed:

1. Remove release bolt (stored outside of the service chamber)
2. Remove two self-tapping screws holding top washer behind the stop washer is a rubber snap plug.
3. Remove snap plug and reinstall the stopwasher.
4. Insert release bolt, tighten enough to mechanically release compression spring.

## **SELF-ADJUSTING BRAKES:**

Periodic adjustments of brakes have been eliminated. Regular inspection of lining water, lubrication and slack adjust travel must still be checked.

## **Adjusting procedure:**

1. Start engine and achieve full system pressure (120 psi)
2. Depress brake pedal fully and hold for one second.
3. Repeat four or more times.
4. Recheck slack adjuster travel

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- ◆ New pads are different thickness

### Rear

Outer pad - 9/16"

Inner pad - 7/8"

### Front

Pads are identical to rear

- ◆ Maximum brake arm travel – Front and rear in 2½"

### **WEEKLY:**

1. Check outboard and inboard pad for wear. ¼" call shops for inspection by mechanic.
2. At least 1/8" of slide pin should show.
3. Check rotors for checks and cracks
4. Check inner pad with mirror and flashlight.

### ◆ **Rotor Inspection**

1. Chock front and rear of a tire not jacked up
2. Jack vehicle up
3. With brake off, rotate wheel, look for checks and cracks. Also check lateral run outs of the disc.

- ◆ LIGHT HEAT CRACKING is normal. – (very fine hairline cracks across the surface of the rotor.) If cracks go completely through the rotor, it must be replaced.
- ◆ During braking operation, the apparatus can develop a steering wheel side to side motion of chatter, this may indicate a warped or cracked rotor.

### **AUXILIARY HAND BRAKE CONTROL:**

- ◆ Is not to be used as a parking brake. Can be used as hill holder or it can be applied when descending grades, but use caution to not create excessive heat.
- ◆ Auxiliary hand brake is applied to rear brakes ONLY. If is only operational when secondary air system reaches 90 psi.
- ◆ This brake can be used effectively while:
  1. Descending grades
  2. Prevent rollback when starting from a stop.

CAUTION: Over use can glaze the pads and crack rotors from excessive heat.

### **AIR RESERVOIR SYSTEM:**

#### Components:

Brake chamber at each wheel, check valves, switch, compressor, dryer, indicator switch, quick release valves, reservoir tanks, safety valves

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- ◆ Air storage tanks:
  - 1 primary @ 90 psi, the secondary tanks begin to fill.
  - 4 secondary
- ◆ Apparatus may be moved when primary reaches 90 psi, however, only rear brakes have full braking power prior to secondary tanks reaching 90 psi.
- ◆ Two air gauges on dash, left gauge on dash indicates pressure in primary tank.
- ◆ Red lights and buzzer on dash will operate when pressure falls below 60 psi and ignition switch is on.
- ◆ Moisture Ejection System - Desiccant type

Removes both liquid and water vapor from the compressor discharge before it reaches air brake reservoir.

Serviced yearly in shops.

**Automatic Bleeders Valve** – located on primary tank operate this “schrader” valve weekly to ensure functioning correctly.

## **AIR OUTLET:**

Mounted on the left side, midship of apparatus to fill tires on extinguishers only.

DO NOT use a spray gun to paint with it.  
DO NOT connect air bottle to it.

Shut-off valve shall be closed when not in use.

A one-way check valve is fitted to the air outlet, this will make it impossible to keep the system charged up with a portable compressor connected to it.

## **AIR CLEANER:**

- ◆ Location: Directly behind the engine access is gained by tilting the cab.
- ◆ Has an exterior "filter" intake screen located in front of jumpseat door on the left side.
- ◆ Dry type, replaced or serviced yearly at shops.
- ◆ Maximum inlet restriction for a clean air filters is 10" of H<sub>2</sub>O.

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- ◆ If the dash gage reads 25" of H<sub>2</sub>O check for restrictions at screen, such as leaves, ashes, paper, etc. If screen is clear call shops for service.
- ◆ When washing apparatus avoid direct water into filter intake.
- ◆ If DUST or DIRT enters the engine rapid wear of the piston rings, cylinder liners, piston and exhaust valve mechanisms. There will be a POWER LOSS and high lubricating OIL CONSUMPTION.
- ◆ If dirt is allowed to build up in the filter, air supply will be restricted, resulting in HEAVY CARBON deposits on pistons and valves. This is due to incomplete combustion.
- ◆ Never direct a stream of water into the intake.
- ◆ Never mount or hang a tool to any part of the housing or tubing.
- ◆ Cleaning the filter is not recommended , serviced at annual pump test or sooner if necessary

### **TURBOCHARGER:**

- ◆ Consists of a turbine wheel and a centrifugal blower, or compressor wheel, separately encased but mounted on and rotating with a common shaft.
- ◆ Forces additional air into engine so it can:
  1. Burn more fuel
  2. Develop more horsepower
  3. Maintain engine's efficiency
- ◆ The power to drive the turbine wheel, which in turn drives the compressor is obtained from energy of engine exhaust gases, can turn up to 60,000 rpm.
- ◆ Is cooled and lubricated by engine lubricating oil.
- ◆ Oil lag or oil starvation to the turbo will cause premature wear on the bearings.
- ◆ **Do not over rev the engine on cold starts. (oil lag to turbo bearings)**  
A periodic check of air cleaner is essential. A clogged filter results in high exhaust temperature, which will damage turbine, bearings, and shaft. Also will cause engine to run over-rich. This will cause engine to smoke excessively.
- ◆ Diesel runaway – See your handout. The information in your handout is taken from this 93 logbook.

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- ◆ Don't shut down engine while hot. May cause temperature or turbocharger to rise 100° above engine temperature and damage bearings.
- ◆ Bi-Monthly inspect the connections, clamps, and couplings, between the air cleaner and the turbocharger. Unfiltered air can cause excessive wear and damage to the compressor section of the turbocharger.
- ◆ Idle 3 to 5 minutes before shutting down...for the same reason you've been reading about in the past six logbooks.

## **CHARGED AIR SYSTEM:**

- ◆ An air to air radiator located in front of engine coolant radiator.
- ◆ Connected between the compressor side of turbo and intake side of engine.
- ◆ Approximately same size as the engine coolant radiator.
- ◆ Works the same way as a standard radiator, turbo sends hot compressed air through air to air radiator then into intake manifold.
- ◆ Provides dense and cooler air – more efficient maintenance of charge air system. Bi-monthly check for cracks, leaks and loose connections.

## **TRANSMISSION:**

- ◆ Spicer PS145-7A, 7 speed, split torque transmission.
- ◆ Two-countershaft design allows engine torque to be equally divided between the two countershafts. This provides a high ratio of torque capacity to the weight of the transmission.
- ◆ All gears are constant mesh, through spur teeth.

### **Maximum speed in each gear:**

<b>Gear</b>	<b>Max. Speed</b>	<b>Ratio</b>
1 <sup>st</sup> -	6.4 mph	10.13
2 <sup>nd</sup> -	10.8 mph	5.99
3 <sup>rd</sup> -	18.1 mph	3.56
4 <sup>th</sup> -	25.1 mph	2.57
5 <sup>th</sup> -	35.0 mph	1.84
6 <sup>th</sup> -	48.5 mph	1.33
7 <sup>th</sup> -	64.5 mph	1.00
Rev. -	6.4 mph	10.13

- ◆ Ordinary starts are in second gear.
- ◆ When engine is under load and the rpm climbs to 1950, shift to a higher gear.

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- ◆ When descending grades hold rpm to max. 1650-1750 rpm or less.
- ◆ Governor WILL NOT control engine when descending hill. Back wheels are driving engine. 200-300 RPM above maximum range will **cause valves to float** .
- ◆ When driving and shifting in the maximum HP range, downshift at 1400-1500 and upshift at 1800-1900 rpm.

### **UPSHIFTING:**

Once governed speed has been attained, shift to neutral, allow rpm to drop approximately 650 rpm (this rpm will vary from one gear to the next) shift to next gear.

### **REAR AXLE:**

- ◆ Rockwell, Model RS-23-180
- ◆ Ratio 3.73 to 1

### **CLUTCH:**

- ◆ 15½ inches in diameter
- ◆ Spicer twin plate dry disc equipped with clutch brake.
- ◆ As disc facing wears, “lash” is reduced.
- ◆ When free travel or “lash” is reduced to 1” - call shops
- ◆ Never allow weight of foot to rest on the clutch. This will result in short life of the clutch release bearing.

### **CLUTCH BRAKE:**

- ◆ Is used to stop the rotation of the transmission gears, to complete a shift into first or reverse, when the apparatus is completely stationary.
- ◆ If a butt-toothed condition exists between the teeth of the gears (clutching teeth), a momentary re-engagement of the clutch will allow the gear train to move into a smooth engagement.
- ◆ Should activate approximately one inch from the floor.
- ◆ For normal up-shifts and down shifts, only a partial disengagement of the clutch is necessary to complete the shift.

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## **STEERING:**

- ◆ **Ross hydropower** integral power steering gear.

## **PUMP:**

- ◆ Waterous Centrifugal (CMUYCX 1500)
- ◆ Two stage pump
- ◆ Series/parallel type.
- ◆ Chain driven
- ◆ Capacity - 1500 gpm @ 150 psi.
- ◆ High-pressure 150 gpm at 600 psi.
- ◆ Pump is hydrostatically tested at 600 psi.
- ◆ Manifold drain – don't drain under pressure.
- ◆ Pressure gauges are liquid filled with damper valves
- ◆ Zinc anodes mounted in pump cavity to prevent pump corrosion.
- ◆ Compound gauge is liquid filled with damper valves – reads positive psi and vacuum in inches of mercury.

## **PUMP TRANSMISSION:**

- ◆ Lubrication is supplied by two methods:
  1. Externally mounted oil pump to pump impeller shaft. This supplies lubrication to upper part of pump transmission when pump is in gear only.
  2. Lubrication to lower section is via the “splash system.” This system operates at all times.

## **PUMP PACKING:**

- ◆ Mechanical type - no adjustment, no leakage. – Notify shops if condition exist.

## **PRIMING PUMP:**

- ◆ Electric driven rotary vane priming pump.

## **TRANSFER VALVE:**

- ◆ Two position controlled by a push/pull handle.
- ◆ Normally changing the transfer valve position, regardless of pressure will not damage pump, however, the operator should always follow procedure developed by their Fire Department.

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## **RADIATOR FILL VALVE:**

- ◆ No damage to the radiator can occur when filling it this way. The increase pressure when the radiator is full will raise the CAP and the coolant will flow out the overflow. Pump water will contaminate radiator water system will need to be flushed. Notify shops for service and flushing.
- ◆ Overfilling the radiator will dilute the coolant.

## **RELIEF VALVE:**

- ◆ Waterous relief valve.
- ◆ A spring loaded, pressure actuated unit that is installed between the discharge and suction sides of the pump.
- ◆ WATEROUS relief valve system consists of two units:
  1. Relief valve proper
  2. Pilot valve (This unit controls the relief valves operation)
- ◆ Controls discharge of 75 psi to 300 psi.
- ◆ Can't control discharge pressure to an amount lower than suction pressure plus 50 psi.
- ◆ When operating from draft or tank no less than 75 psi.

## **PILOT VALVE MAINTENANCE:**

After prolonged pumping - use of dirty water – or in any case, clean the valve....Call shops to disassemble and clean pilot valve.

## **WATER TANK:**

- ◆ 500 gallons, 1/2" polypropylene "pro tank"
- ◆ Flow capacity from tank to pump of 600 gpm.
- ◆ Overflow capacity is rated at 600 gpm.
- ◆ Fill only through inlets with strainers.

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## **SUCTION INLETS:**

- ◆ Two 6" inlets, one on each side, reduced to 4" with 4" keystones attached, no friction loss
- ◆ 4" front suction 5 psi friction loss, 15-30 gpm loss.
- ◆ 3½" auxiliary inlets 50 – 110 FL and also supplies 155-350 gpm less than 4" suction.
- ◆ The above numbers were calculated by flowing between 630-1270 gpm through the 4" main inlet and 4" front inlet.
- ◆ The data for the 3½" auxiliary suction inlets was determined by flowing 630-1090 gpm through each inlet.

(Main purpose of this test was to determine gpm and friction loss in plumbing for all five suction inlets.)

- ◆ Data for maximum gpm at draft was calculated by drafting through each individual suction inlet

4" main inlets	970 gpm
4" front	770 gpm
3½" aux. Inlets	390 gpm

## **RELIEF/DUMP VALVE:**

- ◆ Located on suction side of pump. When incoming pressure greater than 250 psi the valve will bypass excessive pressure and water to pavement via a 2½" male outlet.
- ◆ Do not cap this outlet.
- ◆ A shut-off valve located before the relief/dump valve is to be left open at all times however it can be shut-off if suction pressure is greater than 250 psi is desired.
- ◆ The actual dump valve is located on right side of the pump next to the priming reservoir.

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## **DISCHARGE OUTLETS:**

- ◆ Four 3½” discharge outlets, two aside, panel side are reduced to 2½”.
- ◆ Manifold (each side) connected to three 1½” discharge gates for a total of six 1½”. Each manifold has a shut-off valve and pressure gauge.
- ◆ 3” ball valve to turret.
- ◆ 1½” tank fill between main pump and water tank.
- ◆ 3” ball valve tank to pump dump valve.
- ◆ Slo cloz – controls opening/closing speed of 3” or larger valves “suction or discharge” by use of hydraulics.
  - Bolts to top of valve above the existing handle of the four main discharge gates, two auxiliary suction inlets and wagon battery.
  - Closing time is @ 3 seconds.
- ◆ Has an adjustments plug. When turned clockwise reduces the orifice causing resistance. Shops only can adjust.
- ◆ Principle of Operation – A circular race filled with silicone grease, When open/closing valve, grease is forced through orifice which creates resistance, causes assembly to turn slower.

## **PRIMING PUMP SYSTEM:**

- ◆ Electric driven rotary vane pump mounted on pump transmission.
- ◆ A priming type valve mounted on pump body has a switch on one end enclosed in a housing. This valve is manually opened plunger closes the switch to start the priming pump. Releasing the valve opens the switch to stop the priming pump.
- ◆ Priming control valve –mounted on top of main pump. This valve opens the passage from the main pump to the priming pump.

## **CAB TILTING PROCEDURES:**

### **TO RAISE CAB:**

1. Set the parking brake and shift transmission to neutral before tilting the cab.
2. Make sure all loose equipment inside the cab is either removed or secured.

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3. Plug in remote electric control cable.

### **WARNING! NEVER STAND IN THE PATH OF THE CAB.**

4. Turn on battery master switch and ignition.
5. Remove cab tilt cylinder safety locks from behind front cab doorposts.
6. Close all cab doors before tilting cab.
7. Battery tray must be locked in place before tilting cab.
8. Press the up control button on the remote cable to tilt the cab to full tilt.
9. Make sure that once the cab is tilted to its maximum height, that you "immediately" insert both of the mechanical cab locking devices. (NOTE: see photo 10 item 5).
10. Turn off the ignition switch. NOTE: If the ignition switch is not turned off the engine hour meter will continue to run.

### **TO LOWER CAB:**

1. Before lowering the cab remove the cylinders safety lock assembly from both sides or serious damage may result to the cab structure.
2. Make sure all persons, tools, or other obstructions are clear of pinch points. Position yourself so that you can be certain no personnel are within arms reach of the cab during lowering.
3. Press the down control to lower the cab. When the cab is lowered completely, the spring loaded lock will secure the cab.

### **WARNING!**

- ◆ **NEVER STAND IN THE PATH OF THE CAB.**
- ◆ **NEVER WORK BENEATH THE CAB IN A PARTLY RAISED POSITION. ALWAYS TILT THE CAB TO THE FULL UP POSITION AND USE BOTH CYLINDER SAFETY LOCK ASSEMBLIES BEFORE WORKING UNDER THE CAB.**
- ◆ **KEEP ALL PERSONS AND LIMBS CLEAR OF PINCH POINTS WHEN LOWERING THE CAB TO PREVENT INJURY.**
- ◆ **DO NOT MOVE THE VEHICLE UNLESS THE CAB IS IN THE FULLY LOWERED AND LOCKED POSITION.**

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## **CAB MICRO-SWITCHES:**

- ◆ There are two micro-switches located in the engine compartment. One of the micro-switches is next to the cab located on the right side of the engine compartment.
- ◆ This switch activates a red light on the dash when the cab is unlocked. The red light is labeled (cab not locked). Note: see photo 15 item 8).
- ◆ The other micro-switch is located on the left side of the engine compartment below the fuel filter. This switch stops the cab from raising or lowering if the manual shift is not in neutral. (Note: See photo 15 item 4).

## **PUMPING PROCEDURES:**

### **ROAD TO PUMP:**

1. Stop/spot apparatus
2. Shift to neutral
3. Set parking brake
4. Throw pump shift lever down.
5. Engage road transmission (7<sup>th</sup> gear) Note: two green lights will turn on
  - pump engaged
  - ok to pump

### **PUMP TO ROAD:**

1. Shift transmission to neutral
2. Throw pump shift lever up
3. Release parking brake, apply service brake
4. Engage road transmission

## **PNEUMATIC SHIFT MANUAL OVERRIDE:**

- ◆ Used when system has exhausted its air supply.

ANYTIME THE PUMP WILL NOT SHIFT FROM ROAD TO PUMP, SHIFTING MANUALLY IS DONE AS FOLLOWS:

**NOTE:** IT IS RECOMMENDED THAT THIS PROCEDURE BE PERFORMED USING TWO PEOPLE; ONE PERSON IN THE CAB, AND ONE PERSON AT THE OVERRIDE CONTROL POSITION.

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## **SHIFT TO PUMP AS FOLLOW:**

1. Bring apparatus to a complete stop.
2. Reduce engine to idle speed, put road transmission in neutral.
3. Set parking brake.
4. Move in cab pump shift control into pump position.

**WARNING! THE IN CAB PUMP SHIFT CONTROL MUST BE IN THE PUMP POSITION. IF NOT, AIR PRESSURE MAY PREVENT MANUALLY SHIFTING TO PUMP AND RISING PRESSURE MAY ATTEMPT TO SHIFT BACK TO ROAD.**

5. Push manual shift control rod in, for pump position. Pump engaged light must be on.
6. Wait at least four seconds.
7. Shift road transmission into pumping gear. Pump engaged light must be on.

## **SHIFT TO ROAD AS FOLLOWS:**

1. With engine at idle speed, put road transmission into neutral.
2. Move in cab pump shift lever into road position.
3. Pull manual shift rod out for road position.
4. Wait at least four seconds before engaging road transmission.

## **MISCELLANEOUS INEORMATION:**

- ◆ If drafting, strainer should be at least TWO FEET from the surface of water. Whirlpools forming above suction strainer indicated strainer is too close to surface of water.
- ◆ Cleaning of BUDD CADGARD wheels, water not to exceed 170° degrees F, DO NOT USE ABRASIVE CLEANERS. Products at higher concentration than .20 percent acid or .04 percent caustic can cause permanent damage to chemical shield.
- ◆ Flush entire pump system clean with fresh water for several minutes after handling chemicals, salt water or dirty water.
- ◆ Keep pump either completely full or completely drained, never partially full.
- ◆ Transfer valve should be checked for use of operation on a daily basis.

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- ◆ Excessive idling creates two problems:
  1. Burning gas about 1/2 gal per hour.
  2. Causes engine to operate at dangerously low temperatures and this causes a build up of carbon deposits around injectors, valves, pistons and valve seats.

### **CUMMINS ENGINE BRAKE:**

**“C” brake with three positions (operation is same as Jake brake, see your handout)**

1. Minimum - opens exhaust valves on two cylinders
2. Moderate - opens exhaust valves on four cylinders
3. Maximum - opens exhaust valves on six cylinders

- ◆ Electrical windshield wiper system.

- ◆ IMRON PAINT (polyurethane enamel on the body – no abrasive cleaners use “K.S. Custom Body Jelly” Storeroom stock number = 932 5408.

Audible warning devices:

1. Low voltage
2. Low oil pressure – dash – engineer panel
3. Low air
4. Fuel filter/water separator (entire console)